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STUDIES ON MEASUREMENT OF PCB IN EXHAUST GASES

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STUDIES ON MEASUREMENT OF PCB IN EXHAUST GASES

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Pollution by PCB is becoming severe in recent years. High concentration of PCB was observed in living bodies and it has been causing serious pollution problems. There have been only few studies done on the PCB in the exhaust gases and we do not have a clear understanding of the pollution at present. Therefore, we studied a method of sampling PCB which used a tube filled with glass wool combined with an absorption bottle containing organic solvents with a high boiling point. We applied this method to the study of incinerators in two places. We present the results in this paper.

(I). STUDY OF SAMPLING METHOD

In this experiment, we tested four cases. We first studied the extraction rate of PCB from absorbing liquid (by n-hexane). We filled the liquid separation funnel with a certain amount of absorption liquid. We added the PCB standard solution to it and shook and extracted PCB by n-hexane. This experiment yielded the results that all the absorption liquids (glycerine solution, ethylene-glycol solution, n-propylalcohol solution) were effective. Next, we put a given amount of the PCB standard solution in a flask and heated it and trapped PCB in the absorption liquid. The results showed that a 10% solution of glycerine had the best absorption rate. Also, the first absorption bottle absorbs most of the PCB and therefore two absorption bottles are more than sufficient (see Table 1). Next, we used the absorption liquid (10% glycerine solution) and inserted a tube stuffed with glass wool between the flask and the absorption bottle. We studied the absorption rate by the tube. The result showed that the absorption rate of the tube was very high and about 83%. Combined with the absorption bottle,

this system had the absorption rate of about 96% (see Table 2). This is probably because PCB forms a mist when it passes through the glass tube and is trapped in the tube. Finally, we placed a sheet of pressure sensitive paper containing PCB in the flask and heated it to ∿ 400° C by a burner from the bottom and burned it. This absorption method which combines the tube with the absorption liquid showed that the height of the peak of PCB varied slightly but there was no overall significant change. We could recover more than 90% of PCB from the pressure sensitive paper. The weight of the paper used in this experiment was about 2 g and the tube and the absorption liquid absorbed 23 ppm of PCB in the PCB concentration. When we analyzed the pressure sensitive paper itself, 20 - 27 ppm of PCB was detected. This shows that there was a sufficient amount of PCB absorbed.

In conclusion, the combination of the glass tube and absorption liquids enable us to trap PCB to a sufficient extent.

TABLE 1. THE ABSORPTION RATE OF PCB BY ABSORPTION LIQUIDS

Absorption liquid	The absorption rate (%)		
	First absorption bottle	Second absorption bottle	Total
Glycerine 5%	80.3	13.6	93.9
Glycerine 10%	86.4	10.4	96.8
Ethyleneglycol 5%	85.8	7.9	93.7
Ethyleneglycol 10%	86.2	8.6	94.8
n-propylalcohol 10%	80.2	10.7	90.9
n-propylalcohol 20%	83.4	10.1	93.5
Distilled water	52.4	11.0	63.4

TABLE 2. THE ABSORPTION RATE OF PCB BY COMBINATION OF THE TUBE AND ABSORPTION LIQUID

PCB tested	The absorption rate (%)			
	Tube	First	Second	Total
Biphenyl dichloride	82.1	15.4	0	97.5
" "	83.6	11.0	0	94.6
Biphenyl trichloride	83.1	12.4	0	95.5
" "	85.9	12.0	0	97.9

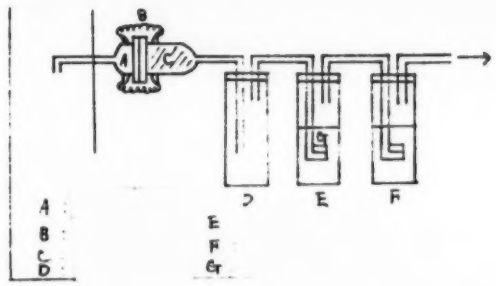

Figure 1. The PCB trapping apparatus consisting of the tube and the absorption bottles.

A- Contact rubbing against each other; B- Clasp; C- Glass wool; D- Trap; E- The first absorption bottle; F- The second absorption bottle; G- Glass filter.

(II). STUDY OF THE EXHAUST GAS FROM THE ACTUAL INCINERATION PLANT

Since we obtained a good absorption rate of PCB in the above-mentioned experiment, we attempted to sample PCB in the actual exhaust pipe. Also, we simultaneously collected the sediments of the sedimentation bath, waste water and ashes and analyzed them. The results showed that high concentration of PCB was not formed and the maximum value was 0.30 $\mu g/nm^3$. This includes only PCB which was found in the tube. PCB was not detected in the absorption liquid. Also, it was not detected in ashes and waste water. The sediments showed only 0.16 ppm of PCB. From these results, we conclude that PCB discharged from these two incineration plants will not cause any problem. As was done in this experiment, if we sample exhaust gas from the actual exhaust pipe and analyze it, the PCB peak shifts from the position observed in the standard PCB solution. This is because the incinerator processes the waste materials at a high temperature (600° C). This shift of the PCB peak made the experiment rather difficult and complex.

ABSTRACT

STUDIES ON MEASUREMENT OF PCB IN EXHAUST GASES. (Haigasuchu no PCB no sokutei ni tsuite). Text in Japanese. Taiki Osen Kenkyu (J. Japan. Soc. Air Pollution), 8(3):598, Oct. 1973. (Presented at the Japan. Society of Air Pollution, Annual Meeting, 14th, Fukushima, Japan, Nov. 6-8, 1973, Paper 319.)

Polychlorinated biphenyls (PCB) in the combustion gas of domestic refuse were measured at two incinerators. First, the measurement method was devised by examination of absorbent and capturing rates. The tests using several organic solvents showed that 10% glycerine solution yielded the best result. For a capturing device, between a flask and an absorption jar, a tube packed with glass wool was installed. The capturing rate of the tube was 83%, and together with the absorption jar, the total capturing rate was 96%, and in some cases 97.9%. This method was then applied to the combustion gas of incinerators. The PCB content in the gas was small, with the maximum measurement of 0.30 microgram/N cu m, which was captured in the tube; there was no trace in the absorbent.